Department of Health and Human Services
U.S. Public Health Service
Indian Health Service
Division of Environmental Health Services

Indoor Air Quality Investigative Guidelines

July 2003

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A. Purpose

Investigating Indoor Air Quality (IAQ) complaints is one of the more challenging areas that an Environmental Health Specialist (EHS) may encounter. Investigations require a prompt response by the EHS. They are time consuming and can require extraordinary amounts of resources. Health professionals and the Indian Health Service have a moral and legal obligation to respond to indoor air quality and mold complaints, but because of limited resources, can only do so to a limited extent. Effective solutions often require a multidisciplinary approach comprising of several individuals with expertise in many specialty areas. The EHS often leads the IAQ investigations, but the extent to which they are involved will be based on the prescribed investigative guidelines and their level of expertise and training. This document was developed to define the role and responsibilities of the EHS regarding IAQ investigations and to serve as a tool to assist the EHS during such investigations. Since conditions and the nature of complaints may vary widely, these guidelines should be applied with flexibility according to the specific situation.

The Indian Health Service's (IHS) legal obligation to address IAQ complaints is largely attributed to the mandate by the "General Duty Clause" of the federal Occupational Safety and Health Act of 1970 and equivalent state OSHA programs. It states that every employer has a "duty" to ensure a safe and healthful work environment. A major provision of Title 29 is Part 1960: Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters. To assist IHS facilities in meeting OSHA requirements, Chapter 9 of the Indian Health Manual titled "Occupational Safety and Health Program" was developed.

The IAQ investigative guidelines were developed for the following purposes: 1) To aid Environmental Health Officers in developing and implementing an effective IAQ program component of the Occupational Safety and Health (OSH) program; 2) To define the role and scope of EHS responsibilities in investigating IAQ complaints, and; 3) To standardize investigative procedures.

B. Objectives

1. Establish a "Standard of Care" to define acceptable IAQ parameters to

serve as a baseline for air quality evaluations.

2. Manage IAQ to reduce liability.

3. Provide a framework for the development of policies and procedures for an effective IAQ Management Program.

4. Define responsibilities for implementing the IAQ Program at all levels, to include headquarters, area, service unit, field, and facility.

5. Standardize the strategy and protocols for investigating IAQ complaints.

6. Establish a reporting system to document IAQ complaints or concerns and to communicate findings and directives to employees, medical staff, and support staff.

7. Define the role and the scope of responsibilities of the EHS regarding investigations of IAQ complaints or concerns.

8. Provide direction and guidance to conduct IAQ investigations.

9. Provide guidance on mold investigations and abatement.

10. Provide direction on air monitoring, testing, and sampling.

11. Provide a list of reference materials for the following:

    a. Basic information about the conditions and factors associated with IAQ.
    b. Acceptable guidelines for basic air parameters.
    c. Mold investigations and mitigation measures.
    d. Forms for documentation purposes.[1]
    e. Staff training resources.

12. Case management of IAQ-related Workers' Compensation cases to include work environment evaluations, employee consultations, investigations, medical referral, and modification of employee work schedules if necessary.

C. Scope

These guidelines are designed to be consulted regarding indoor air quality investigations in any IHS facility, Public Law (P.L.) 93-638 facilities in which IHS personnel are employed, and Tribal facilities.

D. Responsibilities

1. IHS Headquarters

The Institutional Environmental Health (IEH) Program Manager shall set policy, monitor the agency program, provide guidance, and make recommendations for improvements. The IEH Program Manager will also serve as the official liaison between IHS and other federal agencies for the purpose of coordinating investigative and mitigation activities. Further, the IEH Program Manager should ensure that an IAQ Plan and related policies and procedures are in place for all buildings occupied by IHS Headquarters personnel. This plan may be disseminated to Area offices to be used as a template for IAQ Plan development.

The WebCident Reporting System will be used to maintain an IHS surveillance system on the occurrence of documented reports of IAQ concerns and complaints at all IHS and P.L. 93-638 facilities.

2. IHS Areas

The Area Institutional Environmental Health Officer (IEHO) will serve as the main resource for technical assistance regarding IAQ issues. This position will work with Area Facilities Management personnel in performing the following tasks:

a. Maintain an area-wide surveillance system concerning documented reports at all IHS and P.L. 93-638 facilities.
b. Conduct or monitor assessments, investigations and mitigations, including evaluations of the ventilation systems. These activities should draw on skills and expertise of industrial hygienists, facility engineers and others as necessary.
c. Ensure that an IAQ Plan and related policies and procedures are in place for all buildings occupied by IHS personnel.
d. Be available for consultation on IAQ-related issues by P.L. 93-638 facilities and other Tribal facilities.

3. Service Unit Director or P.L. 93-638 Program Director

This position will ultimately be responsible for managing the provisions of these guidelines on the service unit or program level. This position will ensure that the IAQ plan is implemented so that IAQ matters are promptly responded to, managed, and ultimately resolved. For IHS facilities, the Safety Officer or EHS staff will be responsible for managing the IAQ program. P.L. 93-638 programs will need to designate personnel to assume this responsibility.

4. Department Head/Immediate Supervisor

The main responsibility of this position regarding IAQ complaints will be to serve

as the first contact for employees reporting IAQ concerns. If the employee reports the problem to the supervisor, the supervisor should then notify the facility safety officer or EHS. If the employee does not feel comfortable informing the supervisor, he or she should then report the problem directly to the safety officer or EHS.

5. Facility Safety Officer and/or Designee

The safety officer should complete the IAQ complaint form in Appendix A, enter the details of the complaint in the WebCident Incident Reporting System, and print out the report form.[1] Completed incident report forms should be kept on file by the safety officer. The safety officer should also document the complaint on the incident log. An incident log form and other forms involving IAQ complaints and management plans have been produced by the EPA in the document titled "Building Air Quality: A Guide for Building Owners and Facility Managers."[1]

6. Other safety officer responsibilities include the following:

   a. Document and maintain a log of all IAQ complaints or concerns reported at the facility.

   b. Initiate investigation. Conduct employee interviews.

   c. Maintain open communications and provide feedback to both management and employees regarding investigative and remediation activities and results.

   d. Maintain liaison with the medical staff concerning referrals based on IAQ investigations.

   e. Conduct or arrange for necessary environmental sampling and monitoring.

7. Monitor complaints and IAQ-related health conditions after any remedial efforts.

8. Work with the Personnel department to accommodate the employee regarding relocation of workstation, scheduling of work hours, reassignment, and so forth.

9. Coordinate investigations with outside resources when requested.

E. Background

Currently, there are no OSHA regulations for IAQ. However, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Standard 62 specify minimum ventilation rates for indoor air quality that are acceptable to human occupants and are intended to minimize the potential for adverse health effects.[2] Since the "Energy Crisis" of the early 1970's, buildings have been renovated or constructed to be more energy efficient by making them air-tight and designed to use less outside air for ventilation. In addition, new construction techniques and new materials, machines, and consumer products have been introduced that produce more indoor air contaminants. As a result, there has been an increase in the number of occupant complaints and illnesses associated with the buildup of contaminants in the indoor air. This increase in complaints has also resulted in an increased number of Workers' Compensation claims and lawsuits.

Poor indoor air quality can result in three basic classifications of illnesses: Building Related Illness (BRI), Sick Building Syndrome (SBS), and Mass Psychogenic Illness (MPI). BRI refers to infectious diseases such as legionellosis and tuberculosis; allergic reactions such as hypersensitivity pneumonitis; or toxin-induced syndromes resulting from exposure to such agents as carbon monoxide and volatile organic compounds. To be characterized as BRI, the illness must have objective clinical findings related to building occupancy, and be traceable to a specific pollutant or source. SBS has been defined as a complex of symptoms that includes mucous membrane irritation producing nasal irritation and sinus congestion, eye irritation, non-productive cough; headaches; fatigue or lethargy; dry skin; dizziness; and nausea. These symptoms are subjective, rarely associated with clinical findings, and are usually present in some occupants of all buildings some of the time. MPI refers to an apparent epidemic of IAQ-related complaints that probably arises from social or psychological sources rather than toxicological sources. Symptoms might include headaches, fatigue, nausea, hyperventilation, and fainting. MPI is characterized by a sudden onset of symptoms, often coinciding with an unidentifiable odor, and spreads much like a contagious disease. [3,4]
IAQ problems are not limited to clinically defined illnesses. If employees feel that management does not take their complaints seriously, IAQ problems can also lower productivity, increase absenteeism, contribute to workers compensation claims, contribute to poor morale, and result in litigation.

Every building at sometime can experience indoor air quality problems. IAQ complaints can range from a single isolated case to many cases; be localized in a particular room or area of the building, or be widespread; and result in evacuation and closing of the building. A "background" level of IAQ complaints is to be expected of any building's occupants, and there will always be a percentage of occupants who will continue to complain and experience symptoms regardless of improvements made. Even after proper mitigation, it may take days or weeks for contaminants to dissipate and symptoms to disappear.

Although occupant complaints may be related to their workplace, they may not

necessarily be due to the quality of the air. Other environmental stressors, which can occur individually or in combination, such as noise, lighting, ergonomic stressors, and job-related psychosocial stressors contribute to the complaints and can cause symptoms similar to those associated with poor air quality. Employees are typically reporting comfort ventilation issues, not exposure issues. Typically, no specific chemical or biological contaminant can be determined as the cause of the symptoms.

Occupant complaints fall into two categories: 1) complaints of discomfort, including perceptions of poor air quality such as odors, draftiness, and 2) health-related complaints and symptoms. The etiology of non-specific symptoms is multifactorial and involves the interaction of chemical, physical, biological, and psychosocial factors. These factors can also act on an individual to produce stress related symptoms. Physical agents such as temperature, noise, humidity, light, and the ergonomic design of office equipment also need to be evaluated because they can contribute to discomfort and serve as stressors to exacerbate symptoms.

Since there is already an understanding of why buildings have IAQ problems, the focus now is on prevention and a change in investigative strategy to rely more on visual observations and an understanding of a building's condition rather than sampling.

IAQ complaints are time consuming, difficult to resolve, and can be costly depending on the extent of environmental sampling required and the number of outside contractors brought into the investigation. Because of potential litigation IAQ management, including investigations, has become more difficult and demanding. In the event that someone initiates an IAQ claim against an organization, and attempts to recover damages, the plaintiff must demonstrate a failure/negligence on the part of the employer to provide a reasonable "Standard of Care".

Legal actions involving IAQ have produced case law that has redefined the term "SBS". In the past, the term SBS has been applied to buildings in which a substantial percentage of the occupants, more than 20%, report a variety of non-specific symptoms with no causal relationship between the symptoms and a specific cause established. Ventilation guidelines for IAQ set forth by ASHRAE are intended to satisfy 80% or more of the sedentary occupants in indoor environments. However, because of individual variances to exposure to indoor air contaminants, a single case is of sufficient concern to initiate an immediate response by the employer who may face a potential lawsuit.

Due to legal precedence, IAQ investigations that are inconclusive as to the cause should no longer be attributed to SBS. In a legal sense, concluding that an IAQ problem is a result of SBS is in itself an admission of negligence on the part of the employer. Do not use the term "SBS" on documents associated with any

investigations unless it can be confirmed that the facility is causing the problem.

To promote employee health and safety and to protect from liability due to negligence, each facility's Occupational Safety and Health Program should include an IAQ component consisting of the following:

1. Prevention: An IAQ plan and Building Profile (Facility Management).
2. Policies and procedures that clearly identify the goals of the IAQ plan in terms of "Standard of Care" and that this "SOC" is attained and maintained.
3. Investigative policies and procedures to clearly indicate actions to be taken to respond to complaints.
4. Policies that outline measures to be taken to accommodate employees who file Workers' Compensation claims.
5. Air monitoring.
6. Medical referral process.
7. Investigations.

Even when specific causes are obvious, the investigator should not assume that they are the only reason for the complaint. Rather, the investigator should look at a range of potential causes.

F. Role of the Environmental Health Specialist

The purpose of the following procedures is to define the role and the extent of involvement of the EH staff during IAQ investigations, and to provide direction and guidance so that investigations are conducted in a consistent manner. Once an IAQ complaint has been reported, the extent of involvement of EHS personnel will be based on the prescribed investigative guidelines and the level of expertise and training of the individual EHS.

The goal of an IAQ investigation is to identify and resolve the IAQ complaint in a way that prevents it from recurring and that does not create other problems. IAQ investigations require a team effort consisting of several individuals with extensive knowledge and expertise in disciplines such as industrial hygiene, toxicology, microbiology, epidemiology, and so forth. Many IAQ complaints may require a combined approach that collectively employs some or all of these disciplines to successfully resolve the problem. EHS staff should be aware of their level of expertise and limitations when investigating IAQ complaints. Outside assistance may be needed at any point during an investigation and EHS should not hesitate to request it. If the IAQ complaint is not resolved within a reasonable period of time and in accordance with the investigative guidelines, technical assistance from an outside, impartial contractor may then be necessary.

Epidemiological Approach

For the EHS, an epidemiological approach is recommended for IAQ complaint investigations. The measurement of contaminant levels should not be the primary focus of an investigation; at least not initially. The first action should be to establish the existence and the extent of the problem. The primary objective of the early data gathering is to describe the pattern of the problem in terms of person, place, and time. Specific patterns may become apparent that may suggest particular causes and etiological agents. The onset and timing of complaints and symptoms may also lead to a better understanding of the problem.

G. Investigative Procedures:

IAQ investigations should be conducted by the EHS according to the following procedures:

1. Reporting System
2. Document IAQ Complaints and Problems
3. Walk-through Survey
4. Occupant Interviews
5. Building Characterization and Background Assessment
6. HVAC System Assessment
7. Monitoring of Basic Air Parameters
8. Develop Hypothesis and Test
9. Medical Referral

1. Reporting System

How a complaint is handled is not as important as having a system in place to ensure that it is handled. Occupants need to know how and to whom IAQ concerns are to be reported so that an investigation can be initiated. IAQ complaints and incidents should be included as part of the facility's Incident Reporting System. Data should be entered into the WebCident Reporting System.

2. Document Complaints

The EHS is responsible for ensuring that each complaint is properly documented and that required forms are completed. All complaints should be documented regardless of whether they are considered real or perceived. The documentation system can help resolve complaints by collecting information in a way that highlights patterns of problems in terms of person, place, and time. Establishing a recordkeeping system that cross-references complaints with records of equipment operation and maintenance would be ideal. A number of useful forms for documentation are available in the EPA "Building Air Quality: A Guide for Building Owners and Facility Managers", December 1991.

Maintaining a history of complaints is beneficial for the following reasons:

- Distinguish between temporal events such as allergy season and flu season, and unexpected events or chronic indoor air problems.
- Aids in assessing the existence of a problem and whether the complaints are related to indoor air quality, temperature, relative humidity, ergonomics, worker/management relations, or environmental stressors such as noise and lighting.
- Allows one to devise an investigative strategy and support future investigations.
- To identify problem areas.
- Assures occupants that the problem is being investigated.
- Assists in identifying and correcting potentially hazardous conditions in the work place or home environment.

3. Initial Response

Once a complaint has been reported, the EHS shall make the initial contact with the complainant. Each complaint or concern needs to be taken seriously. Respond in a prompt, professional manner regardless if the nature of the complaint is considered by the surveyor to be real or perceived. Listening to and responding to occupants is critical toward achieving a successful resolution. If occupants feel that they are not being listened to and their concerns are not being addressed, the problem can quickly escalate and get worse. The only thing that the EHS should say to the complainant during the initial response is to thank them for bringing the situation to their attention, that their concerns will be investigated, and that you will get back to them. It is very important to follow-up with actions stated to the complainant. If the investigator determines that the nature of the complaint indicates an imminent health threat to the occupants, immediate actions may be necessary, such as eliminating the source of exposure, ordering an evacuation, or summoning emergency response personnel.

4. Occupant Interviews

Do not offer suggestions or lead the occupants in their responses. Allow them to speak while you listen; take notes. Occupants can provide valuable information about the location and timing of activities that may be related to the problem. Occupants may also suggest explanations to help solve the problem. Ask many questions. Ask who, what, when, where, why, and how often. Use open-ended questions like “What have you worked with?” Not, “Have you been exposed to lead?” It may be useful to ask occupants whether there is some reason to suspect that the symptoms are related to their place of work or their home.

The EPA document, "Building Air Quality: A Guide for Building Owners and

Facility Managers" contains forms for occupant interviews and symptom logs. These forms should be used when conducting the investigation[1].

Have occupants keep a log of home and work activities, date and time of symptom onset, and date and time when symptoms disappear. An employee who is unwilling to comply with this request may have unethical motives behind their complaint. Also, the log of information may be useful in the event of future complaints. If the complaints are of odors, have the person describe them. If skin problems are reported, ask if they are using new soap, cosmetics, perfume, and so forth.

The pre-developed EPA questionnaire for interviews is recommended to document the complaint and to gather additional information. The questionnaire should provide additional documentation of the nature of the complaint, the prevalence of symptoms, and onset patterns and their distribution in terms of person, place, and time. Specific symptom patterns may be identified which are indicative of particular agents. The information gathered will help to determine if the problem can be resolved by in-house personnel or if outside professional assistance should be sought.

5. Walk-through Surveys

A major component of IAQ investigations are walk-through surveys. The EHS should conduct a walk-through survey of the area(s) of complaints. The intent of this survey is to acquire a good overview of occupant activities, building functions, and to look for IAQ problem indicators. Many times the etiology of the problem will not be apparent after the initial walk-through and investigation. In these instances, a detailed description of the problem by person, place, and time should lead to new hypotheses. Items to look for during the walk-through survey are as follows:

a. Determine recent structural renovations/design modifications.

b. Assess building design features such as use of office partitions, design of partitions, number of occupants in cubicles, area of complaints, and location of ventilation ducts.

c. Identify potential sources of pollutants such as new carpeting, wall coverings, new furniture, new paint, office equipment, chemical storage, and fabric type.

d. Identify and assess potential onsite sources of pollutants such as parking garages and combustion sources. Also, review the facility's MSDS files and chemical inventory as well as housekeeping cleaning schedules and pesticide applications.

e. Mold amplification sites such as stained ceiling panels, musty odors, and water damaged areas.

f. Housekeeping issues such as cleanliness of spaces, disinfection of fomites to prevent the spread of contagious disease, cleanliness of ventilation ducts, and so forth.

No specific forms are available for this stage of the investigation; however, use should be made of the building's floor plan to plot data from results of the walk-through survey, employee questionnaires and interviews, and supportive information obtained from facility documents. Include the number of occupants per room, room size, and location of office equipment, and location of air intake and exhaust ducts.

6. Building Characterization and Background Assessment

Gather as much historical information that describes the construction and operation of the building as practical; for example, date of construction, basic floor plan, HVAC mechanical drawings, and inspection reports. Determine any changes in building operation and maintenance. This assessment should be coordinated with Facilities Management personnel.

7. HVAC System Assessment

Symptoms associated with poor indoor air quality include headaches, eye irritation, runny nose, sore throat, malaise, skin rash and shortness of breath. This symptom complex may have its etiological roots in a number of causes. One of these causes can be poor ventilation. A thorough assessment of the HVAC system typically requires the professional expertise of either an industrial hygienist or mechanical engineer. EHS staff should have the necessary tools and training for this assessment. Equipment will be necessary to measure airflows, carbon-dioxide levels, relative humidity, air exchanges, and pressure differentials. Without proper instrumentation and expertise, assistance will be necessary from either Facilities Management or an outside resource to assess the HVAC system. Obtain and review all HVAC documents such as mechanical drawings, preventive maintenance schedules, adjustment and balancing reports, inspection records, and operating manuals.

Ventilation measurements are necessary to determine the amount of fresh air delivered to occupants. Measure both supply and return air volumes. When performing these evaluations, reference the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) recommendations. ASHRAE recommends a supply of fresh air at a minimum rate of 20 cubic feet per minute (cfm) per building occupant for the normal office building.

Deficiencies in the HVAC design, operation, or maintenance may exist without producing the complaints under investigation. Some defects may not cause any apparent IAQ problems. If ventilation appears to be a problem, despite a properly functioning HVAC system, the existing system may be inadequate to meet current needs. Facility maintenance staff often encounters difficulties trying to control O&M costs while maintaining an adequate comfort level for occupants.

The AIHA publication "The Industrial Hygienist's Guide to Indoor Air Quality Investigations" has a thorough HVAC inspection checklist that covers items below as well as many others:[3]

a. Determine type and configuration of system components including the number, type, location, and size of fresh air intakes and building exhausts; and zones of the building served.

b. Thorough visual inspection of the system and of the building to detect potential microbial reservoirs and amplification sites and cleanliness of filters, coils, drip pans, and pumps.

c. It is important to understand air flow into and within the complaint area. Measurement of ventilation rates and pathways of air movement should be performed. Chemical smoke can be used to check pathways of air movement. Carbon dioxide measurements can be used to determine ventilation problems.

d. Lead and lag times of HVAC operation. These relate to the timing of the HVAC operation and are designed to optimize efficiency.

e. Short-circuiting between supply and exhaust. This refers to a condition where supply air fails to circulate throughout the room due to close proximity of the return or exhaust vent.

8. Develop Hypothesis and Test

IAQ investigations are a cycle of information gathering, hypothesis formation, and testing. Hypothesis development is a process where several possible causes of the complaints are generated, and then sufficient information is collected to support or refute each hypothesis. A range of potential causes should be considered. If initial hypotheses are not supported, one may need to collect more information about occupants, HVAC system, pathways, or sources. In the absence of additional complaints, the original complaint may have been due to a single, unrepeated event or to causes not directly related to IAQ. However, it is important to inform both the employee and management of the results of all investigative efforts and, if necessary, of recommended corrective actions. Findings need to be documented on the incident log and other appropriate forms as deemed necessary.

9. Air Monitoring

Air quality monitoring has often proven to be inconclusive as concentrations of contaminants are usually considered too low to have caused the symptoms. However, the EHS should measure basic air parameters such as room temperature, relative-humidity, and carbon-dioxide levels. If measurements of chemical contaminants are necessary, then the assistance of an outside contractor may be necessary. This determination should be made after completing the technical review and inspection of the HVAC system; completing the employee questionnaire; measuring actual air flows, and assessing odors.

Do not monitor blindly; have an idea of what you expect to find, and how you will use the results. Develop a sampling plan (what, how many, where, and why). Have a working hypothesis before sampling. If monitoring fails to implicate a cause, create new hypotheses and collect additional information.

Table 1 contains recommended ranges of indoor air parameters and instrumentation for their measurement:[3]

Table 1. Indoor Air Parameters: Acceptable Ranges and Instrumentation

PARAMETER	INSTRUMENT	RANGE OF MEASUREMENT	ACCEPTABLE RANGE
Temperature	Thermometer Thermocouple	30° to 120° F	Winter: 69° to 76°F Summer: 73° to 79°F
Relative Humidity	Capacative Detector Sling Psychrometer	0 to 100% R.H.	30 to 60% R.H.
Carbon dioxide	Infrared Detector Colorimetric tube	200 to 4000 ppm	<750 ppm above outdoor level
Carbon monoxide	Electro—chemical detector Colorimetric tube	1 to 50 ppm	0 to 2 ppm above ambient, <9 ppm avg.
Airflow Rate	Smoke tube Thermal Anemometer Flow hood	Qualitative only 10 to 2000 fpm 10 to 2000 cfm	20 cfm outside air per person

Thermal comfort concerns underlie many IAQ complaints. Temperature and relative humidity (R.H.) are among the many factors that affect indoor contaminant levels. Temperature is the air quality parameter most important to comfort and well-being. High R.H. can promote the growth of mold and increase the off-gassing of chemicals; Low R.H. can cause sore throats, sinus congestion, and skin disorders. R.H. below 30% may cause discomfort from dryness.

CO_2 measurement is a useful screening technique in determining whether adequate quantities of outside fresh air have been introduced and distributed into the building. A CO_2 concentration greater than 750 ppm above the outdoor level indicates inadequate ventilation and should be used as a guideline that helps maximize comfort for all occupants.

Sampling Notes:

a. CO_2 levels typically peak in mid-afternoon. Compare measurements taken at different times of day.

b. Collect CO_2 measurements away from any source that could directly influence the reading, e.g., hold the sampling device away from exhaled breath.

c. Determine the room or zone with the most susceptible occupants, based on results of employee interviews and questionnaires, for measuring basic air parameters.

d. Identify an indoor control zone for comparative sampling purposes. This is an area of no complaints and absence of potential contaminant sources. Take one or more readings in "control" locations to serve as baselines for comparison. Measure outdoor CO_2 levels near the air intake.

e. Compare CO_2 levels measured at varying heights above the floor (2 feet and 7 feet are typical) to evaluate poor air mixing. CO_2 samples should be collected in the breathing zone. Concentrations greater than 750 ppm above the outdoor level in the breathing zone indicate ventilation problems may exist.

f. Monitor temperature and relative humidity at both indoor and outdoor sampling sites.

10. IAQ Program/Profile

Preventing IAQ problems can best be done through the implementation of a proactive IAQ Management Plan, specifically an IAQ Profile. Information needed for the profile is similar to that which is collected when solving IAQ problems, but includes the entire building rather than focusing on areas identified with problems. The profile is a gathering of information and baseline data that is used to develop a description of the features of the building's structure, function, and occupancy that impact IAQ, an owner's manual of the building. Once organized, this information can be referred to in planning for renovations, or responding to future complaints. IAQ management and control need to be part of a building's overall operation and maintenance (O&M) program. Refer to EPA's "Building Air Quality: A Guide for Building Owners and Facility Mangers, December 1991."[1]

11. Medical Referral

If the results of investigations are inconclusive and that no physical cause-and-effect link between the symptoms and exposure were determined, then the EHS should recommend that occupants consult their personal physician if the

problems persist. Furthermore, the EHS should notify the occupants if he or she is no longer going to pursue the matter to avoid false expectations. Explain what was done during the investigation and if the problem reoccurs, report it to the EHS.

H. Instrumentation

Without basic instrumentation, investigators are ill-equipped to conduct a thorough investigation. At a minimum, the following instruments should be available for all EH staff responsible for investigating IAQ complaints:

1. An instrument to measure air flows, flow rates, humidity, and heat flow such as Veloci Calc Plus model 8386(A) with articulating probe.

2. An instrument to measure carbon dioxide levels, temperature, carbon monoxide, and percentage of outside air such as IAQ Calc Plus model 8762.

3. Moisture meter such as Tramex Moisture Encounter or Protimeter.

4. Chemical Smoke for determining air flow patterns and room pressurization.

I. Mold

1. Health Effects

Much of the present day concern about “toxic mold,” especially Stachybotrys, is due to its identification in the mid-1990s in the homes of a small number of Cleveland, Ohio infants with an unusual form of lung bleeding. Although CDC concluded that a possible association between the lung bleeding in the infants and exposure to molds, specifically *Stachybotrys chartarum*, was not proven, mold continues to evoke fear in the public.[5,6]

Fungi are present almost everywhere in the indoor and outdoor environments. Except for persons with severely impaired immune systems, indoor mold is not a source of fungal infections. Current scientific evidence does not support the proposition that human health has been adversely affected by inhaled mycotoxins in home, school, or office environments. Furthermore, studies have failed to show a causal relationship between the presence of toxigenic mold species and adverse health effects. Most of the evidence of severe health effects of fungi in humans is derived from ingestion of contaminated foods, i.e., grain and peanut products or occupational exposures in agricultural settings where inhalation exposures were very high. Indeed, in certain agricultural work settings such diseases as farmer’s lung, grain fever, silo unloader’s syndrome, among others are collectively known as Organic Dust Toxic Syndrome (ODTS).

Also, at these high exposures a Type-III allergic reaction can occur, known as hypersensitivity pneumonitis. With the possible exception of remediation to very heavily contaminated indoor environments, such high-level exposures are not expected to occur while performing remedial work.[7,8]

Moisture problems such as flooding, roof leaks, plumbing leaks, sewage backup, groundwater infiltration, and high relative humidity levels above 70% and so forth, can cause an explosive growth of mold, dust mites, bacteria, and other biological agents. Swamp coolers increase humidity levels which promote and increase the growth of biological agents. Building materials supporting fungal growth must be remediated as rapidly as possible in order to ensure a healthy environment. Repair of the defects that lead to water accumulation or elevated humidity should be conducted in conjunction with or prior to fungal remediation.

It is believed that all fungi produce allergenic substances; however, relatively few have been tested for allergenicity. Fungal allergies are common: 10% of the general population and 40% of asthmatic patients are allergic to fungi. While serious allergic reactions to mold can occur, such as the above-mentioned hypersensitivity pneumonitis, these reactions have been shown to occur only at very high occupational concentrations of fungal spores and fragments. These concentrations occur at levels several orders of magnitude higher than typical levels found in the indoor environment.

The most commonly reported health effect caused from mold exposure is immediate hypersensitivity. This is a Type I, IgE –mediated sensitization reaction whose clinical manifestations can vary from urticarial skin reactions (wheals and flares) to signs of hay fever (rhinitis and conjunctivitis), and among asthmatics can be a precursor to asthma attacks. Indeed, in its 2000 report “Clearing the Air: Asthma and Indoor Air Exposures,” IOM concluded that there is sufficient evidence of an association between exposure to mold and *exacerbations* of asthma, but there was not adequate evidence that molds caused people to become asthmatic.[9]

Relocation of a person due to mold contamination in their home may only be ordered by a team consisting of a qualified physician, EHS, Tribal housing authorities, and other interested parties who are committed to solving the problem. Susceptible populations include those persons who are immunocompromised (such as AIDS patients), the very young or elderly, and those persons with respiratory problems (such as asthma). An EHS alone cannot make determinations or recommendations to relocate a person due to medical considerations.

2. Role of the Environmental Health Specialist:[7]

The activities described below are outlined in “The IHS Division of Environmental Services Position Paper on Mold.” This document states that the role of the EHS

is to advocate mold prevention; engage in an effective risk communication process; perform an initial assessment; and provide guidance to tribes and individuals.

Advocacy
EHOs should advocate local action requiring pre-construction mold prevention efforts. These efforts would include such considerations as proper site selection, design and construction of buildings, and preventive maintenance in HUD-owned and publicly owned buildings.

Also, partnerships should be developed that include all stakeholders regarding mold issues. Some of the partners involved should include Housing and Urban Development (HUD); Tribal housing authorities (THA); Designated Tribal housing entities (DTHE); IHS Sanitation and Facility Construction (internal and external divisions); and other Tribal, medical, or professional organizations.

Risk Communication
EHOs should develop or have access to educational programs based on known facts regarding health risks of mold. They should also learn the basic principles of risk communication in order to effectively address issues where the perception of risk differs significantly from the actual risk. Following is a list of resources that can aid in educational efforts:

- New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments"[10]
- U.S. Environmental Protection Agency (EPA) "A Brief Guide to Mold, Moisture, and Your Home"
- Office of Native American Programs (ONAP)/Housing and Urban Development (HUD) "Mold Prevention and Detection: A Guide for Housing Authorities in Indian Country"
- American Conference of Governmental Industrial Hygienists (ACGIH) "Building Air Quality"
- American Industrial Hygiene Association (AIHA) "The Facts About Mold"
- Sandman PS, Community Outrage: Strategies for Effective Risk Communication" American Industrial Hygiene Association, Fairfax, Virginia. 1993.

Initial assessment
The assessment described here is meant to primarily apply to homes rather than facilities because a facility investigation may use various methods and techniques that are not appropriate for homes. The home assessment should be limited to a thorough visual identification of signs of mold and excessive moisture through non-destructive means. The EHS should not collect samples or perform any activity that is destructive to the structure. A written report of assessment results should be sent to the appropriate parties.

Appendix C contains a Home Mold Assessment Checklist, adapted from the Bemidji Area IAQ Assessment Checklist, to aid the investigator in collecting information on visible mold and moisture incursions within the home.

Mold growth can be hidden in places as under carpet or flooring, behind walls, or in ductwork. Use a moisture meter to identify the extent of water damage to drywall. If mold growth is noted, sampling is not necessary to determine type. Rather, look for water sources and eliminate them. Inspections of ventilation systems will require the assistance of an HVAC contractor experienced in mold remediation.

There are two kinds of moisture meters.

1. Meters containing steel pins that are pushed into a material to measure its conductivity. This type of meter works well for surface measurements as well as measurements deep inside the material.
2. Meters having an electromagnetic wave between two pads that are pressed against a surface. This type of meter is non-intrusive and can quickly obtain measurements.

Both types of meters are generally calibrated for wood. The most versatile model is the **Tramex Moisture Encounter**, which has three scales: one calibrated for wood, one for plaster, and one for masonry. It can penetrate up to one inch in depth, a valuable feature because while the surface may be dry, there could be moisture inside. The cost is approximately $300. (http://www.tramexltd.com/)

Another model is the **Protimeter**. It doesn't go as deep, and uses a combination of pins and electromagnetic radiation. The cost is approximately $500-$600. (http://www.protimeter.com/)

Consider all wet electrical wiring, light fixtures, electrical outlets to be shock hazards until it has been checked by a building inspector or electrician. Until then the electrical power should be turned off. All electrical circuit breakers, ground fault circuit interrupters (GFCIs), and fuses that have been wet should be replaced.

Due to the lack of standards and laboratory methods, sampling for molds is normally not recommended. Generally, microbiological sampling should not be conducted because of difficulty in interpreting results. If a moldy odor is apparent due to microbial volatile organic compounds, (MVOCs), then mold is present and it is alive and metabolizing.

All buildings during their lifetime will likely have some form of water problem. Appropriate management of these water problems will reduce microbial growth. In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur. Any initial water infiltration should be stopped and

cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, dehumidification will be required to maintain/reduce levels below 60% to inhibit mold growth. Emphasis should be placed on ensuring proper repairs of the building infrastructure so that water damage and moisture buildup does not recur.

Generally, the following should be considered when performing a visual mold assessment:

- Look for visible mold growth (may appear cottony, velvety, granular, or leathery and have varied colors of white, gray, brown, black, yellow, green). Mold often appears as discoloration, staining, or fuzzy growth on the surface of building materials or furnishings. When mold is visible, testing is not recommended.
- Search areas with noticeable mold odors.
- Look for signs of excess moisture or water damage. Look for water leaks, standing water, water stains, and condensation problems.
- Search behind and underneath materials (carpet and pad, wallpaper, vinyl flooring, sink cabinets), furniture, or stored items (especially things placed near outside walls or on cold floors).
- Use your sense of smell to locate sources of odors. “Mold odors” are typically described as “earthy” or “musty”. Not all mold growth produces noticeable odors and dormant or dead mold will not be odorous. However, when such odors are detected they are a reasonable indicator of mold, bacteria and wetness.
- Examine or survey suspected areas with a moisture meter to determine locations of elevated moisture within materials or at surfaces in problem areas. Pay attention to colder surfaces, slab floors, hidden spaces, and areas of poor air circulation. Note that a measurement of relative humidity in room air can fail to identify excess moisture because it is not an indicator of the amount of humidity or condensation available to mold growing on a cool surface.

Tools for this inspection include appropriate personal protective equipment such as disposable rubber gloves and respiratory protection depending on the extent of mold growth, a flashlight, moisture meter, a camera, building plans, a ladder, and a tape measure. A licensed building inspector to accompany the EHS during this inspection would be ideal.

To better respond to mold complaints and to better assist tribes, homeowners, and healthcare facilities with mold issues, EHSs should receive more in-depth training on mold, its remediation, and risk communication.

Guidance

EHSs should use the information in this document, and the pertinent reference

material, to provide guidance to tribal communities regarding mold issues. Following is the IHS DEHS position on testing and remediation:

Testing - Sampling should rarely, if ever, be performed. If mold growth is identified, the moisture source must be eliminated and the mold growth abated, regardless of the species involved. If a thorough initial assessment fails to identify the problem and there is still reason to suspect mold growth, then sampling by a qualified professional familiar with current guidelines, using a laboratory accredited through the Environmental Microbiology Laboratory Accreditation Program (EMLAP), may be warranted.

However, all testing methods for mold have limitations that can confound the interpretation of results. Depending on a number of factors, these limitations can over- or under-estimate spore concentrations. Moreover, given the lack of established health risks, there is little benefit to identifying the species of mold.

Remediation – The EHS should be knowledgeable of remediation methods for relatively minor infestations (<10 ft^2 of mold growth) in order to instruct individuals on proper remediation techniques. For mold infestations greater than 10 ft^2, the EHO should provide guidance on identifying a reputable mold assessment and remediation contractor. In all cases, excessive moisture is the cause of mold growth and should be located and corrected or mold growth will recur.

3. Mold Abatement

Workers performing remediation, renovations, or cleaning of widespread fungal contamination may be at risk for developing ODTS or hypersensitivity pneumonitis. ODTS may occur after a single heavy exposure to dust contaminated with fungi and produces flu-like symptoms. It differs form HP in that it is not an immune-mediated disease and does not require repeated exposures to the same causative agent. A variety of biological agents may cause ODTS including common species of fungi. HP may occur after repeated exposures to an allergen and can result in permanent lung damage.

Recommendations made by EHSs to occupants regarding remediation should be based on available general guidelines and the type and extent of damage. Mold abatement procedures are similar to remediation measures taken for asbestos remediation projects. Precautions taken should include proper training of remediation workers; personal protective equipment; work practices to eliminate worker exposures; isolation of the area of contamination; and prevention of the spread of contamination out of the abatement area. The size of the area impacted by fungal contamination primarily determines the type of remediation and whether regular building maintenance staff can perform the remediation or if a certified mold abatement contractor is recommended.

The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area while protecting the health of workers performing the abatement. The primary response to fungal contamination in buildings is the prompt remediation of contaminated material and infrastructure repair. The simplest and most expedient remediation that properly and safely removes fungal growth from buildings should be used. In all situations, the underlying cause of water infiltration must be rectified or fungal growth will recur. Any initial water infiltration should be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough drying, and/or removal of water damaged materials will prevent or limit mold growth. Table 2 contains the EPA recommended guidelines regarding cleaning materials to prevent mold growth within the 24 to 48 hour time frame.

Table 2. EPA Recommended Mold Cleanup and Prevention Guidelines[1]

Water Damage – Cleanup and Mold Prevention	
Guidelines for Response to Clean Water Damage within 24-48 Hours to Prevent Mold Growth*	
Water-Damaged Material†	**Actions**
Books and papers	*For non-valuable items, discard books and papers. *Photocopy valuable/important items, discard originals. *Freeze (in frost-free freezer or meat locker) or freeze-dry.
Carpet and backing – dry within 24-48 hours§	* Remove water with water extraction vacuum. * Reduce ambient humidity levels with dehumidifier. * Accelerate drying process with fans.
Ceiling tiles	* Discard and replace.
Cellulose insulation	* Discard and replace.
Concrete or cinder block surfaces	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	* Discard and replace.
Hard surface, porous flooring§ (Linoleum, ceramic tile, vinyl)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary. * Check to make sure underflooring is dry; dry underflooring if necessary.
Non-porous, hard surfaces (Plastics, metals)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters. * May be difficult to completely dry within 48 hours. If the piece is valuable, you may wish to consult a restoration/water damage professional who specializes in furniture.
Wallboard (Drywall and gypsum board)	*May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace. * Ventilate the wall cavity, if possible.
Window drapes	* Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	* Remove moisture immediately and use dehumidifiers, gentle heat, and fans for drying. (Use caution when applying heat to hardwood floors.) * Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry. * Wet paneling should be pried away from wall for drying.
*If mold growth has occurred or materials have been wet for more than 48 hours, consult Table 2 guidelines. Even if materials are dried within 48 hours, mold growth may have occurred. Items may be tested by professionals if there is doubt. Note that mold growth will not always occur after 48 hours; this is only a guideline. These guidelines are for damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, or chemical or biological pollutants, then Personal Protective Equipment and containment are required by OSHA. An experienced professional should be consulted if you and/or your remediators do not have expertise remediating in contaminated water situations. Do not use fans before determining that the water is clean or sanitary. † If a particular item(s) has high monetary or sentimental value, you may wish to consult a restoration/water damage specialist. § The subfloor under the carpet or other flooring material must also be cleaned and dried. See the appropriate section of this table for recommended actions depending on the composition of the subfloor.	

The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is not recommended. Emphasis should be placed on preventing contamination through proper building construction and maintenance and prompt repair of water damaged areas. ***Air, bulk, or surface sampling should not be part of a routine assessment and are not required to undertake a remediation.*** Effective communication with building occupants is an essential component of all remedial efforts. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals complaining of persistent health problems should be referred to their private physician.

The following levels of abatement are from the "Guidelines on Assessment and Remediation of Fungi in Indoor Environments," New York City Department of Health and Mental Hygiene, Bureau of Environmental and Occupational Disease

Epidemiology.[10] Five different levels of abatement are described in the New York City document; however, only the abatement procedures for Level I are described below. Higher levels of contamination abatement should be performed by qualified professionals. Bulk or surface sampling is not required to undertake remediation.

Level I: Small Isolated Areas (10 sq. ft. or less)

NOTE: If the total contaminated area is greater than 10 sq. ft. then cease in-house remediation and contract with a qualified remediator.

a. ***Remediation can be conducted by regular building maintenance staff.*** Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Wear proper personal protective equipment (PPE), i.e., cartridge HEPA filter respirator or an N-95 disposable respirator, goggles, and disposable gloves.

c. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary, but is recommended in the presence of infants (less than 12 months old), persons recovering from surgery, immune suppressed people, or people with chronic inflammatory lung diseases (asthma, hypersensitivity pneumonitis, and severe allergies).

d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended. Spray the cleaned surface with a mixture of 1 1/2 cups of 5.25% bleach to a gallon of water to disinfect. Spray on disinfectant solution and let sit for 15 minutes. Open windows to ventilate.

e. Once dry, clean all hard surfaces with a mild detergent and let surface dry. Contaminated materials that cannot be cleaned should be removed from the building in a sealed plastic bag. Remove and replace wet carpeting and pad. If in a basement, recommend not to install wall-to-wall carpeting and to utilize area rugs. There are no special requirements for the disposal of moldy materials.

f. The work area/areas used by remedial workers for egress should be cleaned with a damp cloth and/or with a mop and detergent solution.

g. All areas should be left dry and visibly free from contamination and debris.

h. Recommend to hire a contractor to inspect the building for structural problems and/or plumbing that caused the water damage and make necessary repairs.

i. Winterize home to prevent water intrusion through walls, ceiling, and around windows.

j. Use a mildewcide additive to paint for surfaces requiring painting.

k. Following elimination of the water source, remove and replace all water damaged drywall, insulation, and ceiling tiles contaminated with mold. A moisture meter can be used to determine the extent of water damage to the drywall. Remove the drywall at least 2 feet above the moisture line. Capture dust and debris with a high efficiency particulate air (HEPA) vacuum cleaner. Replace drywall with “Green” board in high moisture areas, i.e., kitchens, bathrooms, laundry rooms, basements, etc. Double bag mold contaminated materials for disposal.

Source: New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology, Guidelines on Assessment and Remediation of Fungi in Indoor Environment[10]

J. Selected Websites

New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology, Guidelines on Assessment and Remediation of Fungi in Indoor Environment.
http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html

National Institute of Occupational Health and Safety (NIOSH), Building Air Quality: A Guide for Building Owners and Facility Managers.
http://www.cdc.gov/niosh/baqtoc.html

U.S. Department of Housing and Urban Development (HUD) Office of Native American Programs (ONAP), Mold Prevention and Detection: A Guide for Housing Authorities in Indian Country.
http://www.codetalk.fed.us/MoldDetection.pdf

U.S. Environmental Protection Agency (EPA), A Brief Guide to Mold, Moisture, and Your Home. http://www.epa.gov/iaq/molds/moldguide.html

U.S. Environmental Protection Agency (EPA), Mold Remediation in Schools and Commercial Buildings. http://www.epa.gov/iaq/molds/mold_remediation.html

U.S. Environmental Protection Agency (EPA), Indoor air quality publications and resources. http://www.epa.gov/iaq/pubs/index.html

U.S. Environmental Protection Agency (EPA), Building Air Quality: A Guide for Building Owners and Facility Managers.
http://www.epa.gov/iaq/largebldgs/baqtoc.html

K. References

1. U.S. Environmental Protection Agency (EPA), Building Air Quality: A Guide for Building Owners and Facility Managers. Washington, DC: EPA, 1991.

2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Standard 62 – 1989: Ventilation for Indoor Air Quality. Atlanta, GA, ASHRAE, 1989.

3. American Industrial Hygiene Association (AIHA), The Industrial Hygienist's Guide to Indoor Air Quality Investigations. Fairfax, VA, AIHA, 1993.

4. American Industrial Hygiene Association (AIHA), The Occupational Environment – Its Evaluation and Control. Ed. DiNardi, Fairfax, VA, AIHA, 1997.

5. Centers for Disease Control and Prevention (CDC), Acute pulmonary hemorrhage/hemosiderosis among infants - Cleveland, January 1993-November 1994. MMWR 1994;43:881-3.

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7. Indian Health Service (IHS), Indian Health Service Division of Environmental Health Services Position Paper on Mold. (unpublished) 2003.

8. Hardin BD, Kelman BJ, Saxon A, Adverse Human Health Effects Associated with Molds in the Indoor Environment, *Evidence-based Statements*, American College of Occupational and Environmental Medicine, [Online], www.acoem.org/guidelines/evidence [2002, October 27].

9. Committee on the Assessment of Asthma and Indoor Air, Institute of Medicine (IOM), *Clearing the Air: Asthma and Indoor Exposures*, National Academy Press, Washington, D.C., 2000.

10. New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments," [On-line] http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html#remed [December 2002].

L. Selected Readings

American Conference of Governmental Industrial Hygienists (ACGIH), Guideline for the Assessment and Control of Bioaerosols. Cincinnati, OH, ACGIH, 1997.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Standard 55 – 1992: Thermal Environmental Conditions for Human Occupancy. Atlanta, GA, ASHRAE, 1992.

Baker, DB, Epidemiological Investigation of Office Environmental Problems, Ann.Am. Conf. Gov. Ind. Hyg., Vol. 10 (1984), pgs. 37-44.

Burge, HA, Fungi: toxic killers or unavoidable nuisances?, Annals of Allergy, Asthma, & Immunology, 87:52-56, 2001.

Indian Health Service, Bemidji Area Division of Environmental Health Services Guidelines on Assessment and Remediation of Fungi in Indoor Environments. 2003.

Appendix A

Note: This appendix only contains the form for indoor air quality complaint reporting. The below EPA document contains the following indoor air quality management and investigation forms: Management Checklist; Pollutant Pathways for IAQ Profiles; Zone/Room Record; Ventilation Worksheet; IAQ Complaint Form; Incident Log; Occupant Interview; Occupant Diary; Log of Activities and System Operation; HVAC Checklist (long and short forms); Pollutant Pathways for Investigations; Pollutant and Source Inventory; Chemical Inventory; and Hypothesis Form.

U.S. Environmental Protection Agency (EPA), Building Air Quality: A Guide for Building Owners and Facility Managers. Washington, DC: EPA, 1991.
http://www.epa.gov/iaq/pubs/occupgd.html

Indoor Air Quality Complaint Form

This form can be filled out by the building occupant or by a member of the building staff.

Occupant Name: _____ Date: _____

Department/Location in Building: _____ Phone: _____

Completed by: _____ Title: _____ Phone: _____

This form should be used if your complaint may be related to indoor air quality. Indoor air quality problems include concerns with temperature control, ventilation, and air pollutants. Your observations can help to resolve the problem as quickly as possible. Please use the space below to describe the nature of the complaint and any potential causes.

We may need to contact you to discuss your complaint. What is the best time to reach you? _____

So that we can respond promptly, please return this form to: _____
IAQ Manager or Contact Person

_____
Room, Building, Mail Code

OFFICE USE ONLY

File Number: _____ Received By: Date _____ Received:_____

Appendix B

Checklist of Questions for Choosing a Mold Removal Specialist

1. Verify that the contractor and their employees have appropriate training and project experience. Ask for references and contact clients to verify that the consultant has helped them solve their mold problem.

2. Ensure that the most experienced personnel will be on-site or in direct contact with the site investigation or remediation staff.

3. Make sure they advocate eliminating moisture incursion first, then cleaning with a simple detergent solution.

4. Draw up a request for proposal (RFP) or contract specifications.

5. Make sure they use accepted guidelines such as those established by The New York Department of Health and Mental Hygiene; American Society of Heating, Refrigeration and Air Conditioning Engineers; or American Industrial Hygiene Association.

6. Make sure they insured and bonded.

7. Determine whether they avoid sampling and testing in most cases. Sampling and testing is expensive and is the “bread-and-butter” of many unscrupulous contractors.

8. If they do sample, ensure they use a laboratory accredited by the Environmental Microbiology Laboratory Accreditation Program (EMLAP).

9. It would be beneficial if they are members of community organizations such as the Chamber of Commerce.

Appendix C

DEPARTMENT OF HEALTH AND HUMAN SERVICES
U.S. PUBLIC HEALTH SERVICE/INDIAN HEALTH SERVICE

HOME MOLD ASSESSMENT CHECKLIST

BASED ON SURVEY RESULTS, THE ITEMS BELOW INDICATE MOISTURE AND WATER INCURSION PROBLEMS LEADING TO MOLD GROWTH. THIS SURVEY IS BASED ON GUIDELINES ESTABLISHED BY THE US EPA, NYC DEPT. OF HEALTH, WISCONSIN DEPT OF HEALTH AND FAMILY SERVICES AND THE MINNESOTA DEPT. OF HEALTH.

Facility ID	**Date of Survey**
Address	**No. of Residents**

SITE CHARACTERISTICS

SOIL TYPE (e.g. clay, sand, grave, loam, consult soil survey)

SOIL DRAINAGE CHARACTERISTICS

DEPTH TO WATER TABLE (ft.)

LANDSCAPING: (shrubs, trees, gardens against building)

BUILDING DISTANCE TO
Swamps/wetlands _____
Dry-cleaners/Laundry _____
Compost _____
Other _____

EXPLAIN SITE DRAINAGE

EXTERIOR

TYPE OF HOME (circle one)
conventional apartment attached garage
mobile one-story detached garage
modular multistory

YEAR OF CONSTRUCTION

SIZE (sq. ft.)

TYPE OF SIDING: (circle all that apply apply)
brick concrete vinyl earth EFFS
stone wood aluminum Stucco other_____

CONDITION OF SIDING: (circle one)
good poor damaged visible mold/mildew warping
fair leaks corroded rot blistering paint

TYPE OF WINDOWS/DOOR: (circle all that apply)
wood aluminum
vinyl other_____

CONDITION OF WINDOWS/DOORS
good poor damaged visible mold/mildew rot
fair leaks corroded warping

ROOFING CONDITION (circle all that apply)
good poor damaged shingles
fair leaks corroded flashing

EXTERIOR (CON'T)

ROOF VENTILATION (circle all that apply)
ridge vent soffits gable end vent Roof Vent Fan

ROOF GUTTER SYSTEM (circle one)
yes no

GUTTERS DRAINS WATER >5FT FROM BLDG (circle one)
yes no

INTERIOR

TYPE OF WALLS (circle all that apply)
plaster with lathe paneling vinyl other_____
sheetrock/gypsum wood wallpaper

CONDITION OF WALLS (circle all that apply)
good poor damaged visible mold/mildew rot
fair leaks corroded warping blistering paint

TYPES OF FLOORS (circle all that apply)
wood tile vinyl sheet goods
carpet other_____

BASEMENT (circle one) yes no

CRAWL SPACE (circle one) yes no

TYPE OF BASEMENT/CRAWLSPACE FLOOR
poured concrete carpet dirt other_____
vinyl tile stone block

SUMP PUMP (circle one) yes no

DAMP (circle one) yes no

STANDING WATER (circle one) yes no history

CRACKS IN WALLS (circle one) yes no

CRACKS IN FLOOR (circle one) yes no

IN FLOOR DRAIN/PUMP (circle one) yes no

DEHUMIDIFIER (circle one) yes no

BASEMENT WALLS (circle all that apply)
plaster paneling stone other_____
sheetrock poured concrete concrete block

CONDITION OF BASEMENT WALLS (circle all that apply)
good poor damaged visible mold/mildew rot
fair leaks corroded warping blistering paint
staining/efflorescence

HVAC

PRIMARY SYSTEM (circle one)
gas LP wood oil electric kerosene
wood burning stove coal burning stove fireplace
unvented space heater other _____

DISTRIBUTION SYSTEM (circle one)
forced air gravity hydronic
electric radiant other_____

FURNACE FILTERS (CIRCLE ONE)
fiberglass fabric electronic plastic
chemical adsorption devices (activated charcoal, alumina)

COOLING SYSTEM (circle one)
central air windows window air conditioner
evaporative cooler none

HOT WATER HEATER (circle all that apply)
electric part of boiler gas
gravity vented power vented
properly drained improperly drained

CHIMNEY (circle one) yes no
Condition (circle one) good fair poor
Gas-fired appliance connected (circle one) yes no

ASBESTOS (circle one) yes no
Condition (circle one) good fair poor
Friable (circle one) yes no

HUMIDIFIER (circle one) yes no

WATER SUPPLY(circle one)
private well PWS cistern/haul surface other_____

SEWAGE (circle one) city septic mound

COOKING APPLIANCES
Type: (circle one) gas electric woodstove

Ventilation: (circle one) recirculation outside exhaust none

OTHER

BATHROOM
Mechanical Ventilation (circle one) yes no window

Mech. Ventilation wired to (circle one)
lighting humidstat individual switch

Condition/Functioning of Bathroom Ventilation (circle one)
good fair poor damaged
visible mold/mildew/dust

TOILET
insulated tank (circle one) yes no
supply line tempered (circle one) yes no

LAUNDRY FACILITIES
Dryer vented outside (circle one) yes no

WATER SOFTENER (circle one) yes no
properly drained (circle one) yes no

ATTIC
Living space mechanical ventilation vents to the attic (circle one)
yes no
Unprotected and non-insulated openings into Attic (circle one)

yes no

ADDITIONAL COMMENTS:

ENVIRONMENTAL SAMPLING MEASUREMENTS

SAMPLING /MEASUREMENTS	Basement	**Kitchen**	**Living Room**	**Master Bedroom**	**Bedroom**	**Bathroom**	**Attic**	**Other**	
RELATIVE HUMIDITY									
TEMPERATURE									
CARBON DIOXIDE									
CARBON MONOXIDE									
VENTILATION EFFECTIVENESS									
MOISTURE METER READINGS									
OTHER									

ENVIRONMENTAL SAMPLING MEASUREMENTS

SAMPLING /MEASUREMENTS	Other								
RELATIVE HUMIDITY									
TEMPERATURE									
CARBON DIOXIDE									
CARBON MONOXIDE									
VENTILATION EFFECTIVENESS									
MOISTURE METER READINGS									
OTHER									

NOTES:

INSPECTION FINDINGS

OBSERVATIONS	Basement	Kitchen	Living Room	Bathroom	Bedroom	Laundry	Hallway	Closet
VISIBLE MOLD								
MUSTY SMELL								
ANIMAL/FECAL ODOR								
PLUMBING LEAKS								
CONDENSATION ON PLUMBING/WINDOWS ETC.								
CHEMICAL STORAGE								
HOUSEKEEPING*								
HOBBIES/CRAFTS								
LIST PESTICIDES								
WATER STAINS								
STAINS (OTHER)								

OBSERVATIONS	Exterior	Other						
VISIBLE MOLD								
MUSTY SMELL								
ANIMAL/FECAL ODOR								
PLUMBING LEAKS								
CONDENSATION ON PLUMBING/ WINDOWS								
CHEMICAL STORAGE								
HOUSEKEEPING*								
HOBBIES/CRAFTS								
LIST PESTICIDES								
WATER STAINS								
STAINS (OTHER)								

*General housekeeping rating guidelines listed below. This is subjective and based on inspectors interpretation.

Good: well maintained, items in normal lived in appearance
Fair: maintained, some disarray, the day's dishes in sink, clothes scatter in bedrooms, unswept floors
Poor: several days dishes in sink, soiled laundry scattered over floor, presence of animal excrement

Notes:

PHOTO LOG

Location	Photo No.	Explanation:

NOTES: